

Activity A

5.3 Exploring Equations in Point-Slope Form

MATERIALS • graph paper • straightedge

QUESTION What information is known about the equation $y - 5 = 3(x - 1)$?

EXPLORE Solutions of equations

Complete the following Steps for each of the three equations and ordered pairs below.

a. $y - 1 = 2(x - 3)$ b. $y + 4 = -3(x - 2)$ c. $y - 5 = \frac{1}{3}(x + 6)$

(3, 1), (-3, -1), (0, -5) (-2, 4), (2, -4), (0, 2) (-6, 5), (6, -5), (0, 7)

STEP 1 Solutions

Record the two ordered pairs that are solutions of the equation.

a. _____ b. _____ c. _____

STEP 2 Slope

Find the slope between the two ordered pairs. Record your answers below.

a. slope = _____ b. slope = _____ c. slope = _____

STEP 3 Graph

Plot the two ordered pairs on your graph paper, use your straightedge to draw the line that passes through the points.

STEP 4 Equation

Rewrite each equation so it is in slope-intercept form.

a. $y =$ _____ b. $y =$ _____ c. $y =$ _____

DRAW CONCLUSIONS Use your observations to complete these exercise

1. Are each of the original equations linear? *Explain.*
2. What are the slopes and y -intercepts of the lines you drew in Step 3?
3. Do your answers to Exercise 2 agree with the slopes and y -intercepts of the equations you wrote in Step 4?
4. What is the slope of the line with equation $y - 7 = 5(x - 12)$?
5. By inspection, how could you tell the slope of each of the original equations?
6. Name a point through which the line $y - 7 = 5(x - 12)$ passes.
7. For each of the original equations you recorded two ordered pairs that satisfied the equation in Step 1. One was the y -intercept. Complete the statement: The other point had the same _____ as in the equation, but _____ signs.
8. Complete the statement: When the equation of a line is $y - a = m(x - b)$ the line passes through the point _____ and has slope _____.

Answer Key A

EXPLORE

STEP 1

a. $(3, 1)$ and $(0, -5)$

b. $(2, -4)$ and $(0, 2)$

c. $(-6, 5)$ and $(0, 7)$

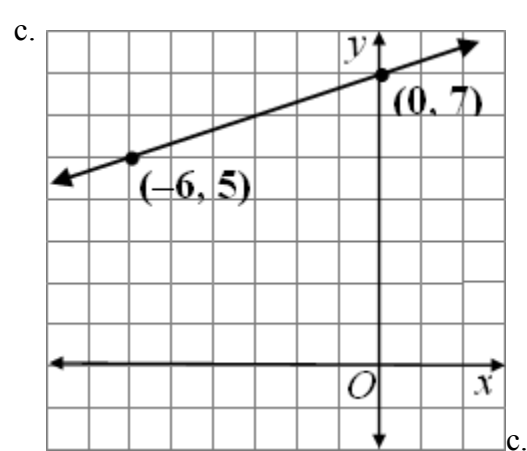
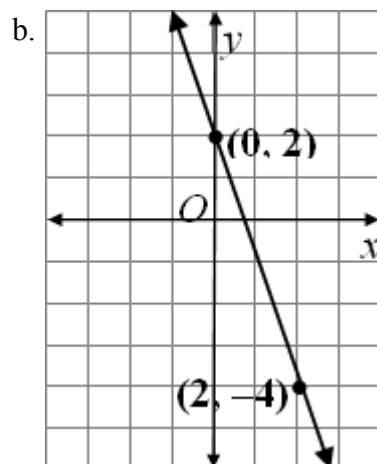
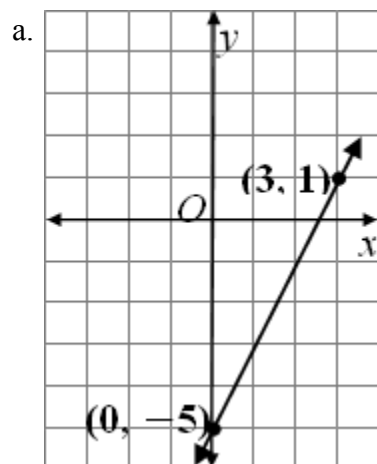
STEP 2

a. slope = 2

b. slope = -3

c. slope = $\frac{1}{3}$

STEP 3



STEP 4

a. $y = 2x - 5$

b. $y = -3x + 2$

c. $y = \frac{1}{3}x + 7$

DRAW CONCLUSIONS

1. Yes; you are able to write each equation in slope-intercept form so each equation is a linear equation.
2.
 - a. slope = 2, y-intercept = -5
 - b. slope = -3 , y-intercept = 2
 - c. slope = $\frac{1}{3}$, y-intercept = 7
3. yes
4. 5
5. The slope is the factor outside the parentheses on the right side in each of the original equations.
6. (12, 7)
7. numbers; opposite
8. (b, a) ; m

Teacher Notes

ACTIVITY PREPARATION AND MATERIALS

- Any size graph paper can be used for this activity.
- This activity can be done individually or in groups of 2 or 3. Decide how you will divide the class.

ACTIVITY MANAGEMENT

- This activity presents equations in point-slope form. Without knowing the name for this equation, students are still able to work with the equation. At this point students know the slope-intercept form and the standard form of a linear equation. They may well suspect this is just another form of a linear equation that hasn't been simplified. The goal is for students to recognize that an equation such as $y - 2 = 3(x - 4)$, is indeed an equation of a line with slope 3 and passing through (2, 4).
- Introduce the activity by asking what forms of linear equations students are already familiar with. Students should mention the slope-intercept form and the standard form and be able to give an example of each. Next ask if $y - 5 = 3(x - 1)$ is in slope-intercept form or standard form. The answer is no. Ask if there are any ordered pairs that they can think of that satisfy the equation. Suggest trying to find (0, ____) and (1, ____). Once they have answered these questions they should be ready to begin the activity.
- In the Explore students will need to determine which two of the three given ordered pairs satisfy the equation. This is done by substitution. Next they find the slope between the two ordered pairs. At this point some students may notice that their answer is the same as the factor being distributed on the right side of the equation.
- Students then plot the two ordered pairs and draw the line between them. Students may confirm that the graph "agrees" with the slope that they calculated. The last step is for students to transform the given equation by using the distributive property and solving for y . Again students should note that the equation "agrees" with the graph that they made.
- You may want to have students share their results for the 4 Steps before beginning the Draw Conclusions exercises. Have students work together in their groups or with a partner to answer Exercises 1–8. When they finish, discuss the results as a class.
- Exercise 6 is the most difficult in terms of students describing their observations. They may recognize that the x - and y -values in the ordered pairs are used in the original equation, but they either ignore the issue of the sign, or have difficulty describing the difference in the sign. You may need to lead this portion of the discussion.
- Go back to the equation posed before they began the activity: $y - 5 = 3(x - 1)$ and the two ordered pairs generated (0, 2) and (1, 5). Use this example as a reference for Exercise 6. Bring this discussion to a close by talking about the point-slope form: $y - y_1 = m(x - x_1)$. This line passes through the point (x_1, y_1) and has a slope of m .

Activity and Closure Questions

Ask these questions as a class.

1. What is the slope of the line with equation $y - 3 = 2(x + 4)$? Name a point through which the line passes.

Answer: slope = 2; $(-4, 3)$

2. Write the equation of the line that passes through $(5, -2)$ and has a slope of $\frac{1}{2}$, in the form $y - y_1 = m(x - x_1)$.

Answer: $y + 2 = \frac{1}{2}(x - 5)$

3. Write $y + 7 = -2(x + 1)$ in slope-intercept form.

Answer: $y = -2x - 9$

4. If an equation is written in $y - y_1 = m(x - x_1)$ form, what must be done to write it in slope-intercept form?

Answer: Distribute m on the right side of the equation, add y_1 to both sides of the equation, and simplify the equation.

LESSON TRANSITION

After completing this activity tell students they have been using the Point-Slope Form of a linear equation. Tell them that the point-slope form of a nonvertical line through a given point (x_1, y_1) with a slope of m is $y - y_1 = m(x - x_1)$. Students have been provided with enough material in this activity to skip Example 1 and to have a quick discussion of Examples 2 and 3. You should be able to spend the rest of the lesson on the word problems in Examples 4 and 5.